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(54) PROJECTION TYPE PICTURE DISPLAY DEVICE

(57)Abstract:

PURPOSE: To prevent the contrast ratio of a projected picture from being lowered even in a bright room by making the device have a selective screen having such reflection spectral characteristics that reflectance on plural wavelength areas is high and reflectance on the other areas is low.

CONSTITUTION: The projection type picture display device is constituted of a projection optical system 1 and the selective reflection screen 2 which has the reflection spectral characteristics that the reflectance is high on at least three wavelength areas and the reflectance is low on the other wavelength areas. The projection optical system 1 is constituted of a light source 3, a liquid crystal panel 5 which parallel beams from a collimator lens 4 are made incident, a dichroic mirror 6 synthesizing light beams transmitted through the panel 5 to each color, and a projection lens system 7 projecting the synthesized light beams on the selective reflection screen 2. The light source 3 has emission spectrum where the wavelength corresponding to three color components R, G and B is set as the central wavelength and whose band width is narrow; and the reflection characteristic of the

screen 2 is set to obtain the high reflectance only on the wavelength which nearly coincides with the spectrum of the light source, and to obtain the low reflectance on the other wavelength band.

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CLAIMS

[Claim(s)]

[Claim 1] Said screen is a projection mold image display device to which it is characterized by being a selective reflection screen with a reflection factor low in the wavelength field of others that that reflective spectral characteristic has [and] a reflection factor high in at least three wavelength fields in the projection mold image display device equipped with the incident light study system and the screen which projects a display image by this incident light study system at least.

[Claim 2] An incident light study system according to claim 1 is a projection mold image display device characterized by consisting of the light source, a liquid crystal panel in which this parallel light carries out incidence after making into parallel light light emitted from this light source, a dichroic mirror which compounds the transmitted light which penetrated this liquid crystal panel in each color, and a projection lens system which projects the light compounded in each color with this dichroic mirror on said selective reflection screen.

[Claim 3] The light source according to claim 2 is a projection mold image display device characterized by optical intensity distribution having high reinforcement that much in the wavelength field which has the high reflection factor of said selective reflection screen.

[Claim 4] For a selective reflection screen according to claim 1, the reflective spectral characteristic is the projection mold image display device to which it is characterized by a reflection factor being 50% or less in the wavelength field of others having [and] a high reflection factor in at least three wavelength fields.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to a projection mold image display device.

[0002]

[Description of the Prior Art] Generally, a projection mold image display device projects an image on a large-sized screen, and displays an image. As an example of this equipment, a slide projector is common knowledge. Then, a slide projector is explained with reference to Fig. 2.

[0003] A slide projector consists of irradiating a color film 21 in the source 23 of the white light through the KORIME lied lens 22 from a tooth back, and projecting the transmitted light based on image information on the large-sized screen 25 by the incident light study system 24, for example, a projector lens, in Fig. 2. The reflection property of this large-sized screen 25 has the desirable thing of the white for which a reflection factor does not depend on wavelength. In order to use it as a movie, it is sufficient, if a sequential change of the color film is made in time at the same principle of operation and it displays as an animation.

[0004] By the way, the liquid crystal projector which uses a liquid crystal display panel and projects an image on a screen by the same incident light study system instead of this color film in recent years is spreading. The optical system to which the liquid crystal projector shown in Fig. 3 uses as the main component the dichroic mirror 32 which carries out spectral decomposition of the light from red (R), green (G), and the source 32 of the white light that minded [blue (B) / three] the collimate lens 31, Three liquid crystal display panels 33 which display the shade image information corresponding to R, G, and B of these three colors, The optical system which uses as the main component part the dichroic mirror 34 (or dichroic prism (not shown)) which compounds the light of R, G, and B which penetrated three liquid crystal display panels 33, It consists of an incident light study system which consists of a projector lens 35 for projecting a synthetic light on a screen (not shown).

[0005]

[Problem(s) to be Solved by the Invention] However, the technical problem common to the above-mentioned projection mold image display device has the low brightness of the image on a screen, and is making the room dark and seeing it. That it is necessary to see in the dark room leads to it being difficult to see an image plainly in everyday life space, and it is the greatest factor which has prevented the indicating equipment from

above-mentioned spreading through ordinary homes like a television receiver.

[0006] It is the most direct approach to raise the output of the light source for attaining this that what is necessary is just to raise brightness for solving this technical problem. However, in order that a projection mold image display device may carry out expansion projection of the display image by the incident light study system at a large-sized screen, since the high thing is required for the quantity of light of the light source, fundamentally, it is close to the point light source, and, also technically, making the quantity of light increase further has a limit. Moreover, although raising the quantity of light of the light source will raise the illuminance to a display image, under a high illuminance, property degradation of a polarizing plate, and an array substrate circuit element and a liquid crystal ingredient is accompanied by a liquid crystal display panel etc., and it leads to the engine performance of equipment, and the fall of dependability.

[0007] By the way, it is [of raising the brightness of equipment] reasonable in securing the contrast ratio of the image on which it was projected by the screen as mentioned above also under a bright environment. The bright room is a location with much so-called outdoor daylight. Generally, since a screen cannot fully oppress reflection of these outdoor daylight, it cannot take the brightness contrast ratio of the background light and the projection image by the scattered reflection of outdoor daylight, but it is supposed in the bright room that visibility falls it. From these things, the projection image display device to which the contrast ratio of a projection image is not reduced in the bright room is offered by this invention.

[0008]

[Means for Solving the Problem] In order to solve an above-mentioned technical problem, the projection mold image display device of this invention is equipped with an incident light study system and the screen which projects a display image by this incident light study system at least, and has a reflection factor with that reflective spectral characteristic high in at least three wavelength fields on this screen, and is characterized by being a selection screen with a low reflection factor in other wavelength fields.

[0009]

[Function] In this invention, what has an emission spectrum with the narrow bandwidth which makes main wavelength wavelength corresponding to R, G, and B was used as the light source to what was decomposing and using the source of the white light which has continuous spectrums, such as a metal halide lamp, as a source of the flux of light which irradiates a liquid crystal panel conventionally for 3 color components of R, G, and B with the dichroic mirror etc. Moreover, conventionally, to having used the thing

of the white for which a reflection factor does not depend on wavelength conventionally, the reflection property of a screen constituted the reflection property of a screen from this invention so that it might be a high reflection factor only on the wavelength which carried out abbreviation coincidence and might become the spectrum of the narrow-band width of face of this light source with a low reflection factor in other wavelength bands.

[0010] In this invention, decline in the utilization factor of light can be prevented by making in agreement the spectrum of the projection device light source, and the wavelength band of a high reflection factor of a selective reflection screen. On the other hand, the reflection factor of a selective reflection screen is a high reflection factor only in the limited band, since it is a low reflection factor, the outdoor daylight which is generally the white spectral characteristic of a continuous spectrum reflects on a selective reflection screen, and the quantity of light included in an eye reduces it in other wavelength bands. Therefore, the contrast ratio of the brightness of a projection image and outdoor daylight reflection of a selective reflection screen will improve sharply. Here, the reason which the reflection factor made 50% or less in other wavelength fields is that the effect of outdoor daylight is set to one half, and becomes more than twice from this as a contrast ratio.

[0011]

[Example] Hereafter, the example of this invention is explained based on a drawing. In Fig. 1, the screen, i.e., that reflective spectral characteristic, which projects a display image by the incident light study system 1 and this incident light study system 1 has a reflection factor high in at least three wavelength fields, and the projection mold image display device consists of selective reflection screens 2 with a low reflection factor in other wavelength fields.

[0012] This incident light study system 1 consists of the light source 3, the collimate lens 4 which changes the light from this light source into parallel light, a liquid crystal panel 5 in which this parallel light carries out incidence, a dichroic mirror 6 which compounds the transmitted light which penetrated this liquid crystal panel 5 in each color, and a projection lens system 7 which projects the light compounded in each color with this dichroic mirror 6 on the selective reflection screen 2.

[0013] Next, each component of this incident light study system 1 is explained in full detail. The light source 3 has the peak of luminescence reinforcement in wavelength lambdaR corresponding to a red (R) component, a green (G) component, and a blue (B) component, lambdaG, and lambdaB, and the bandwidth of the spectrum consists of each light sources narrow enough. These emission spectrum intensity distribution are shown

in Fig. 4. As for such the light source 3, a mercury lamp, a metal halide lamp, etc. are mentioned. The halogenide of the mercury metallurgy group to enclose can be obtained by selecting an ingredient and vapor pressure according to a demand spectrum. Moreover, according to the light source which emits a thing and two or more emission spectrums with the wide bandwidth of an emission spectrum, a desired property can also be acquired by forming the reflective film which the front face of an outside ball is made to penetrate only a desired spectrum, and is made to reflect unnecessary spectral light in a light source side. Fluorescence tubing applied to the outside ball inside is sufficient as the fluorescent substance which furthermore has a desired emission spectrum. Since the request spectrum of each [these] light source is independent, since the metallic material, vapor pressure, a fluorescence ingredient, etc. can be chosen independently and a degree of freedom is in the design of the light source, they are efficient and can supply the light source with a good property. The peak of the luminescence reinforcement of each light source 3 is lambdaR=630nm, lambdaG=530nm, and lambdaB=450nm respectively. Since color reproduction will become faithful even if it uses it without component conversion of the signal of R of a video signal, G, and B component if it is chosen as near, it is desirable.

[0014] After making it parallel light with a collimate lens 4, the light emitted from this light source 3 is constituted so that incidence of the permeability modulation may be carried out to the liquid crystal panel 5 carried out by each color component signal. After each color composition is carried out with a dichroic mirror 6, the transmitted light of a liquid crystal panel 5 is constituted so that it may project on a selective reflection screen by the projection lens system 7. The configuration after liquid crystal panel 5 is the same as the conventional configuration of a liquid crystal projector shown in Fig. 3, and good. however, the spectrum of a dichroic mirror 6 -- although the conventional thing is also easy to be natural [a reflection property] -- the spectrum from the light source -- as shown in Fig. 6, and shown in Fig. 7, since spectral intensity is discrete as shown in Fig. 4, each dichroic mirror 6 and DM1 can use DM3 as the mirror of full wave length reflection in DM2 The design of a dichroic mirror 6 becomes easy by doing in this way, and the set configuration of a low price is attained.

[0015] In the wavelength field which, on the other hand, included the emission spectrum of the light source of each color component for the reflective spectral characteristic as the selective reflection screen 2 was shown in Fig. 5, a high reflection factor is shown, and it constitutes from a wavelength field between each spectral intensity peak with low spectral intensity so that it may become a low reflection factor. Although the concrete construction of the selective reflection screen 2 which has such

the reflective spectral characteristic can consider various things, the example is shown below. Fig. 8 and Fig. 9 show an example of the construction by the interference filter. Fig. 8 is a cross-section block diagram of a screen. The multilayer interference filters 62, 63, and 64 are uniformly constituted by black substrate of low reflection factor, i.e., low reflective substrate, 61 front face. As shown in Fig. 9, the interference filters 62, 63, and 64 of each class reflect the incident light of each wavelength field where a high reflection factor is demanded, neither of the interference filters, 62, 63, nor 64, is reflected, but even the low reflective substrate 61 reaches, and the light of other wavelength fields is absorbed with this substrate 61. Figs. 10 are other examples which constituted the screen from a multilayer absorption mold filter. The absorption mold filters [AF / AF, AF /2 /, and / 3] 1 and AF4 which absorb light in a specific wavelength band on the front face of the reflecting plate 73 with which the reflective film 72 was formed in substrate 71 front face, and penetrate light on it in other bands It forms. The transparency spectral characteristic of each class is designed as shown in Fig. 11. The light of the wavelength field where permeability is low is absorption filter AF1, AF2, AF3, and AF4. It is absorbed and they are absorption filter AF1, AF2, AF3, and AF4. The reflection factor in a front face is stopped sufficiently low. Therefore, the general absorption filters [AF / AF, AF /2 /, and / 3] 1 and AF4 The light of the wavelength field to penetrate reaches the reflective film 72 of substrate 71 front face, and they are the general absorption filters [AF / AF, AF /2 /, and / 3] 1 and AF4 again. It penetrates and outgoing radiation is carried out from a selective reflection screen front face. Absorption filter AF1 which has such the transparency spectral characteristic, AF2, AF3, and AF4 A layer is easily realizable by forming the film which added the pigment which has a specific spectral extinction property in a polymer. moreover, the thing for which these pigments are mixed -- all absorption filter AF1, AF2, AF3, and AF4 It comes out further and constituting is also possible. Moreover, since there is little angular dependence of incident light, the reflective film is used as a dispersion reflecting plate, or this absorption mold filter fits the structure which prepared the lenticular lens between reflective film so that screen gain might be given. Moreover, constituting from a component on a flexible screen is also easy.

[0016]

[Effect of the Invention] By taking an above-mentioned configuration, with the projection mold image display device of this invention, reflection of the outdoor daylight in a screen is generated only in a specific narrow wavelength field by use of a selective reflection screen, and it is not absorbed and reflected in one layer of the screens in other wavelength fields. since outdoor daylight is generally what is depended

on the sunlight and the scattered reflection light of a tonneau light which carry out incidence indoors -- the spectral characteristic -- some strength -- being certain -- be alike and carry out -- it is a continuous spectrum. Therefore, a part for the light energy corresponding to the absorption field of a screen in the reflective energy of the outdoor daylight from a selective reflection screen is reduced. On the other hand, since the spectrum of the incident light from a projector is in agreement with the reflective spectral characteristic of a selective reflection screen, reflective energy is not decreased. Consequently, since only the reflective energy of outdoor daylight is reduced, the contrast ratio of light reflected from the opaque screen of that reduction part image improves.

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Configuration simplified schematic showing the example of the projection mold image display device of this invention,

[Drawing 2] Configuration simplified schematic showing an example of the conventional projection mold image display device,

[Drawing 3] Configuration simplified schematic showing an example of the projection mold image display device of the conventional liquid crystal method,

[Drawing 4] the spectrum of the light source needed by this invention -- an intensity-distribution Fig.,

[Drawing 5] The part light reflex property Fig. of the selective reflection screen of this

invention,

[Drawing 6] Drawing showing the part light reflex property and part light transmission property of a dichroic mirror DM 1 which were shown in drawing 1 ,

[Drawing 7] Drawing showing the part light reflex property and part light transmission property of a dichroic mirror DM 2 which were shown in drawing 1 ,

[Drawing 8] Cross-section structure simplified schematic showing an example of the selective reflection screen which constitutes this invention,

[Drawing 9] The property Fig. showing the part light reflex property of the selective reflection screen shown in drawing 8 ,

[Drawing 10] Cross-section structure simplified schematic showing other examples of the selective reflection screen which constitutes this invention,

[Drawing 11] It is the property Fig. showing the part light transmission property of the absorption filter layer of the selective reflection screen shown in drawing 10.

[Description of Notations]

(1) -- Incident light study system

(2) -- Selective reflection screen

(3) -- Light source

(4) -- Collimate lens

(5) -- Liquid crystal panel

(6) -- Dichroic mirror

(7) -- Projection lens system